The control of dingoes in New South Wales in the period 1883-1930 and its likely impact on their distribution and abundance

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ABSTRACT

The sheep grazing industry has been an economic mainstay of New South Wales from the early period of European settlement. The dingo quickly established itself as a predator of sheep and a pest of the pastoral industry. In the latter decades of the nineteenth century, a system was established under which bounties were paid on a wide range of species, but bounties paid for dingoes were far in excess of those paid for other species. In addition, an exclusion fence was built, spanning 8,614 km and three States, to prevent dingoes from reinvading south-eastern Australia. This level of control effort reflects the importance of the dingo as a pest of the sheep industry.

In the period between 1883 and 1930, over 280,000 bounties were paid for dingoes in New South Wales. At the beginning of this period, dingoes appeared to be distributed throughout New South Wales. By 1930, dingoes were scarce in all but the north-eastern corner of the State. The highest numbers of sheep were grazed in the areas that showed the most rapid decline in dingo numbers, while relatively low numbers were grazed in the areas where dingoes remained common.

No relationship was observed between the value of bounties offered and the number of scalps submitted. The main incentive for the destruction of dingoes by humans is likely to have been the protection of stock, rather than the monetary reward of the bounty payments.

Key words: Dingo, Bounty, Pest control, Vertebrate pests.

INTRODUCTION

The Dingo *Canis lupus dingo* has existed in Australia for around 4,000 years and is thought to have been introduced by Asian seafarers (Corbett 1995a). At the time of European settlement, the dingo was present throughout mainland Australia (Corbett 1995a). Today it is absent from most of New South Wales, with the exception of the forested coastal ranges, where it remains common in many areas, and the far north-west corner of the State, where it exists in low numbers (Harden 1985; Corbett 1995a). It is unclear exactly when the dingo was eliminated from much of New South Wales.

The dingo has been regarded as an agricultural pest since the early years of European settlement (Rolls 1969; Strahan 1988). Its importance as a pest is related principally to its predation on sheep and, to a lesser extent, on cattle (Breckwoldt 1988). Both adult and juvenile sheep are vulnerable to predation by the dingo, and surplus killing (killing in excess of dietary requirements, Kruuk 1972) can lead to further substantial losses. Predation on cattle, however, is usually limited to calves (Rolls 1969; Green and Catling 1977; Corbett 1995b).

Control of dingo populations has been undertaken by various means including shooting, trapping, poisoning and fencing, and has been encouraged by the payment of scalp bounties (Corbett 1995a). The payment of bounties began in New South Wales in 1852 with the introduction of "An Act to Facilitate and Encourage the Destruction of Native Dogs" (Breckwoldt 1988). In 1880, the payment of bounties on noxious species became the responsibility of the Pastures and Stock Protection Boards (later shortened to Pastures Protection Boards). Dingoes were among the first species subject to bounties under this system. Although the bounties on many species were reduced after a number of years and eventually stopped, dingo bounties remained relatively high in many areas (Jarman and Johnson 1977).

Despite the control efforts of farmers and governments, the number of dingoes in Australia as a whole has increased since European settlement (Corbett 1995b). Artificial water holes and the related increase in the number of stock and macropods may have contributed to their increase (Corbett 1995a; 1995b). In some areas, rabbits are a common prey item in the dingo's diet (Strahan 1988; Corbett 1995b), and Breckwoldt (1988) and Corbett (1995a) suggest that the arrival of rabbits in Australia may have led to increased numbers of dingoes.

This study collates data on bounty payments made by Pastures Protection Boards in New South Wales between 1883 and 1930. These data are used to address the following questions:

1. What was the distribution of dingoes in New South Wales prior to and at the turn of the century?
2. What importance did dingoes have as a pest relative to other species for which bounties were paid?
3. Did the distribution and abundance of dingoes (as indexed by bounty payments) change over the period of study? Can these payments be used to assess the spatial and temporal pattern of decline?
4. Were there any surges in dingo numbers with the arrival of the rabbit?

METHODS

Records collated by the Pastures Protection Boards detailing the number of bounties paid for dingoes and other noxious species were published annually in the *New South Wales Government Gazette* (Short 1998). In 1903, there were 65 boards covering the entire area of New South Wales (Fig. 1). Bounty payments from the years 1883–1930 were investigated for each of these areas. After 1930, the historical records became too sporadic for analysis.

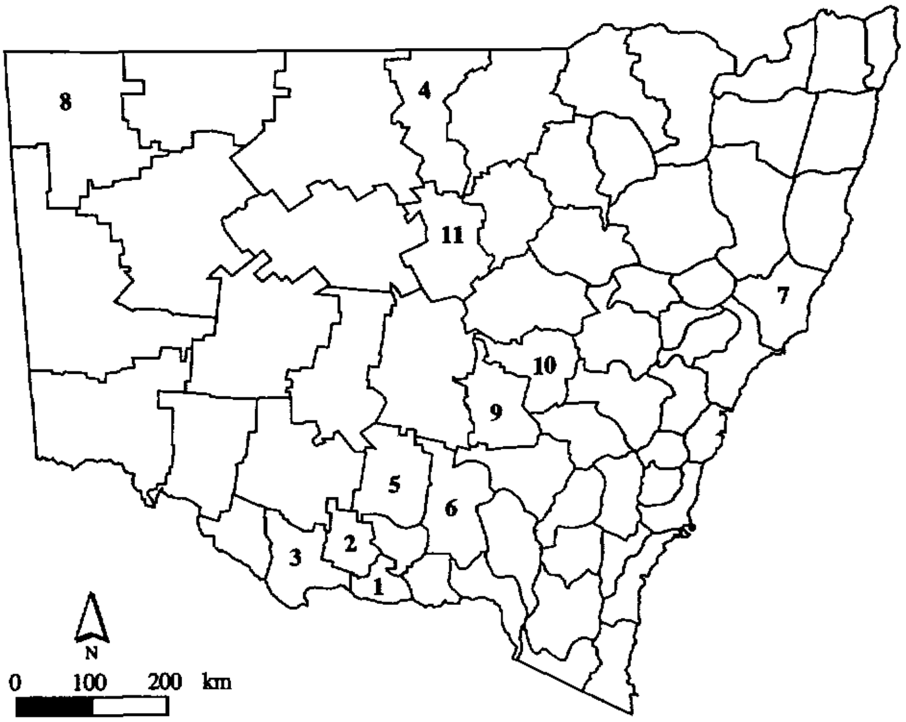

Figure 1. Map of New South Wales showing the boundaries of the Pastures Protection Districts operating in 1903. Districts referred to in the text are numbered. 1. Corowa, 2. Jerilderie, 3. Deniliquin, 4. Brewarrina, 5. Narrandera, 6. Wagga Wagga, 7. Port Stephens, 8. Milparinka, 9. Forbes, 10. Molong, 11. Canonbar.

Records of bounty payments do not necessarily provide an accurate reflection of the abundance and distribution of dingoes (Harden and Robertshaw 1987). Various social and economic factors, as well as the abundance of dingoes, may influence the number of scalps submitted for bounty (R.H. Harden, pers. comm. 1999). However, despite these potential influences, we believe they are sufficiently accurate to indicate broad trends in distribution and abundance when records from individual boards are amalgamated across regions and across 5-year periods.

The changing distribution of dingoes during the period of study was investigated as follows. The number of bounties paid for dingoes were collated for each Pastures Protection Board for the five-year periods 1886–1890, 1896–1900, 1906-1910, 1916-1920 and 1926-1930. The total for each period was divided by the areas of the respective districts to provide an index of the density of dingoes. These densities are displayed on maps with shading indicating areas of similar levels of scalp return.

For each of the same five-year periods the average bounty offered for adult dingoes was calculated for each district. Once again, maps were produced with similar shading indicating areas that offered similar bounties.

The importance of the dingo relative to other pest species was gauged by comparing the prices paid for all pests on which a bounty was offered. This included adult and juvenile dingoes, various marsupials, birds, and introduced species such as foxes and rabbits.

Variations in the index of dingo populations over time were assessed by dividing the State into zones and regions (Fig. 2) after Short (1998). The State was divided into four zones, based on topography and land use: Coast, Tablelands, Slopes and Plains. Each was further divided into three regions: South, Central and North. Bounty payments on dingoes were collated by year for each region and the number of bounties paid was plotted against time.

RESULTS

Between 1883 and 1930, 286,398 bounties were paid for dingoes in New South Wales; an average of approximately 6,000 per year. The highest number of bounties per 100 km^2 was paid on the Coast, followed by the Tablelands, Slopes and, finally, the Plains (Table 1). For the State as a whole, the number of bounty payments reached a peak in the decade 1891-1900 (Table 2). This trend was echoed on a regional scale by the Tablelands and Slopes. Bounty payments peaked

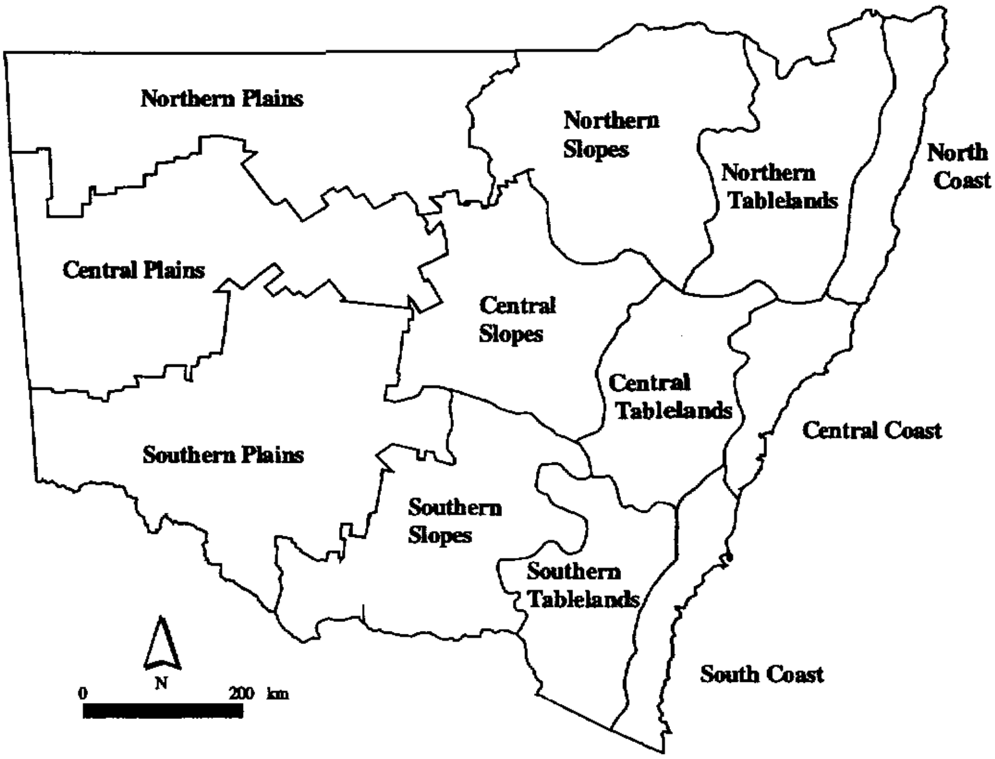

Figure 2. Map of New South Wales showing the twelve geographical regions.

Table 1. Distribution of dingo scalp returns by zone (1883-1930).

Region	Approximate area (km^2)	Bounties Paid	Bounties per 100 km^2
Coast	74,970	57,058	76.1
Tablelands	140,053	91,973	65.7
Slopes	198,142	62,173	31.4
Plains	312,305	75,194	24.1
Total	725,470	286,398	39.5

Table 2. Numbers of dingo bounties paid by zone in each period.

Period	Coast	Tablelands	Slopes	Plains	Total
1883-1890	7,546	16,749	7,207	7,071	38,573
1891-1900	9,943	26,334	29,130	21,653	87,060
1901-1910	12,715	21,572	12,918	14,605	61,809
1911-1920	12,855	17,554	10,449	24,585	65,446
1921-1930	13,999	9,789	2,469	7,280	33,537
Total	57,058	91,973	62,173	75,194	286,398

in both of these regions between 1891 and 1900, before declining in the following three decades. The decline was most marked on the Slopes where the dingo scalp payments for 1921-1930 were 8.5% of those for 1891-1900. Payments on the Plains also peaked between 1891 and 1900, declined and then resurged to a higher peak in the decade 1911-1920. Payments for the region then dropped sharply in the final decade of the study period. In contrast to all other regions, scalp returns in the Coastal region showed a gradual increase throughout the study period.

The distribution of dingoes in New South Wales, as indicated by the bounty figures, for the periods 1886-1890, 1896-1900, 1906-1910, 1916-1920 and 1926-1930 respectively, is shown in Fig. 3. Dingoes were present throughout the State at the end of the nineteenth century (Fig. 3a,b). At the turn of the century, the distribution of dingoes was concentrated around the Coast, Tablelands and Slopes (Fig. 3b). The Northern Slopes, Northern Tablelands, Central Slopes and Central Tablelands supported high densities of dingoes, as did the South Coast and the southern edge of the Tablelands. Moderate densities of dingoes were present in the Northern Plains and Central Plains.

A trend towards a contraction of the dingo's range was evident by 1910 (Fig. 3c). Scalp returns in the Southern and Central Slopes were noticeably reduced, while the South Coast, Northern Slopes and Central Tablelands also showed a decline. The Central Coast and North Coast, however, showed an increase in scalp returns during the same period. Scalp returns in the north-west corner of the State remained moderate.

By 1920, the distribution of the dingo appears to have been greatly reduced (Fig. 3d). The lack of scalp returns from the Southern Slopes and the few returns from the Southern Tablelands, Central Slopes, Northern Slopes and Southern Plains suggest that dingoes were scarce or absent. The North Coast, parts of the Central Tablelands, Northern Tablelands and Northern Slopes, the Central Coast and parts of the Northern and Central Plains still appear to have supported moderate to high densities, as judged by scalp numbers.

By 1930, the dingo's range had altered little since the previous decade (Fig. 3e). High numbers of bounty payments still occurred on the North Coast and Central Coast, as well as the Northern Tablelands. Dingoes continued to occur throughout most of the Plains, although scalp returns on the Northern Plains and Central Plains had fallen since 1920.

The decline of the dingo in the southern and central regions is further illustrated by the values of bounties offered (Fig. 4). At the turn of the century, every operational Pastures Protection Board in the State offered a bounty on dingoes, with the exception of Corowa (Fig. 4b). No data are available for Jerilderie and Deniliquin at this

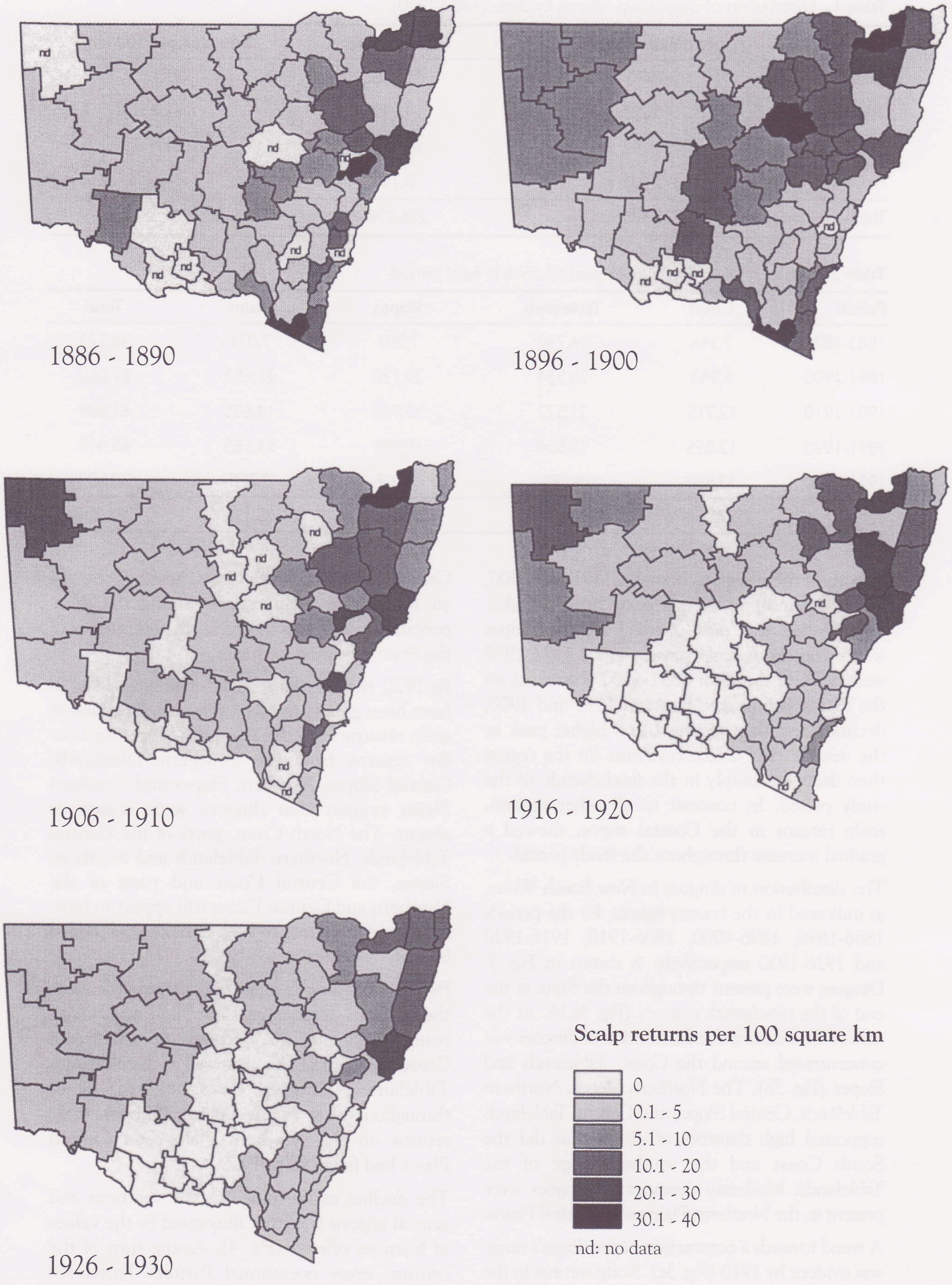
1886 - 1890
1896 - 1900
1906 - 1910
1916 - 1920
1926 - 1930
nd
Scalp returns per 100 square km
0
0.1 - 5
5.1 - 10
10.1 - 20
20.1 - 30
30.1 - 40
nd: no data

Figure 3. Distribution and relative density of dingoes as assessed by scalp returns for the periods (a) 1886-1890, (b) 1896-1900, (c) 1906-1910, (d) 1916-1920 and (e) 1926-1930.

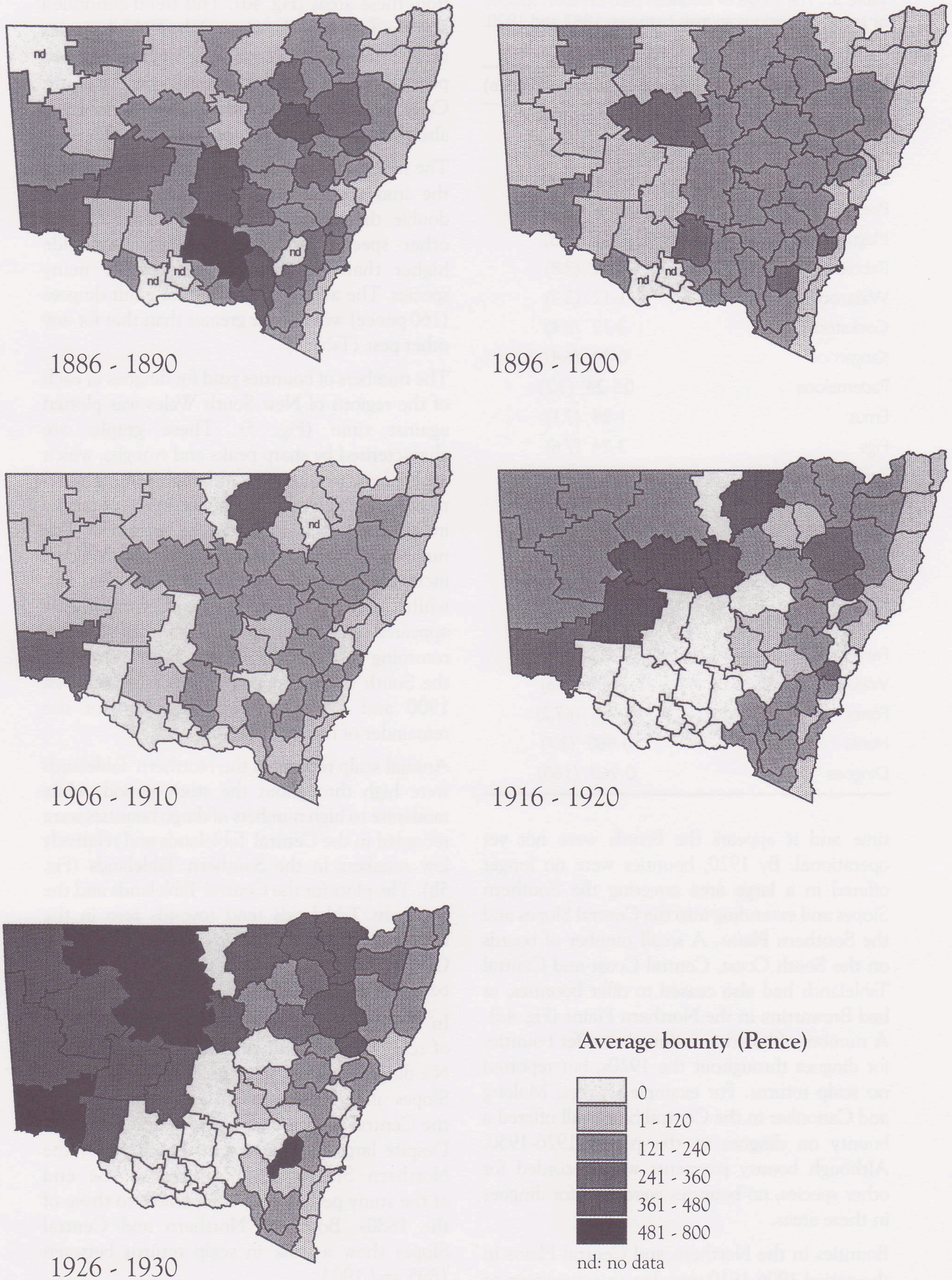
nd
nd
nd
nd
nd
1886 - 1890
nd
nd
1896 - 1900
nd
1906 - 1910
1916 - 1920
1926 - 1930
Average bounty (Pence)
0
1 - 120
121 - 240
241 - 360
361 - 480
481 - 800
nd: no data

Figure 4. Average bounties offered for adult dingoes in the periods (a) 1886-1890, (b) 1896-1900, (c) 1906-1910, (d) 1916-1920 and (e) 1926-1930. Note that £1 = 240 p.

Table 3. The range of bounties paid on each species or group of noxious animals between 1883 and 1920. (Mean values shown in parentheses).

Species or Group	Range of Bounties (Pence)
Sparrows	0.5 (0.5)
Flying foxes	1 (1)
Bandicoots	1-3 (2.2)
Possums	1-4 (1.7)
Magpies	1.5-6 (2.3)
Rabbits	0-12 (3.8)
Wallaroos	1-12 (5.3)
Cockatoos	3-12 (8.4)
Kangaroos	0-24 (6.4)
Pademelons	0.5-24 (3.2)
Emus	1-24 (7.1)
Pigs	3-24 (7.6)
Kangaroo rats	1-48 (2.4)
Bilbies	30-60 (38.6)
Wombats	0-120 (22.4)
Crows	0-120 (5.1)
Eagles	0-120 (22.1)
Hawks	6-120 (31.6)
Feral dogs	30-300 (90.5)
Wallabies	0-480 (3.6)
Foxes	0-480 (67.2)
Hares	0-480 (3.7)
Dingoes	0-960 (160)

time and it appears the boards were not yet operational. By 1920, bounties were no longer offered in a large area covering the Southern Slopes and extending into the Central Slopes and the Southern Plains. A small number of boards on the South Coast, Central Coast and Central Tablelands had also ceased to offer bounties, as had Brewarrina in the Northern Plains (Fig. 4d). A number of boards continued to offer bounties for dingoes throughout the 1920s, but reported no scalp returns. For example, Forbes, Molong and Canonbar in the Central Slopes all offered a bounty on dingoes in the period 1926-1930. Although bounty payments were recorded for other species, no bounties were paid for dingoes in these areas.

Bounties in the Northern and Central Plains in the period 1906-1910 were low in comparison to other areas (Fig. 4c). However, by 1920, bounties in these regions were relatively high, suggesting an increased emphasis on removal of dingoes from these areas (Fig. 4d). This trend continued into the following decade and, by 1930, bounties across most of the Plains were in excess of 360 pence (£1 10s) (Fig. 4e). Bounties on the North Coast, Northern Tablelands and Northern Slopes also increased during this period.

The maximum bounty offered for dingoes during the study period was 960 pence (£4). This is double the maximum amount offered for any other species, and an order of magnitude higher than the bounties offered for many species. The average price paid for adult dingoes (160 pence) was also far greater than that for any other pest (Table 3).

The numbers of bounties paid for dingoes in each of the regions of New South Wales was plotted against time (Fig. 5). These graphs are characterised by sharp peaks and troughs, which are difficult to interpret, although some general trends are observed. The date of arrival of rabbits in each region is indicated by an arrow. The number of scalps received in the North Coast increased during the period of study (Fig. 5a), while scalp numbers in the Central Coast appeared to peak between 1900 and 1910 before returning to a moderate level. Scalp returns in the South Coast dropped considerably between 1900 and 1905 and remained low for the remainder of the study period.

Annual scalp returns in the Northern Tablelands were high throughout the study period, while moderate to high numbers of dingo bounties were recorded in the Central Tablelands and relatively low numbers in the Southern Tablelands (Fig. 5b). The plots for the Central Tablelands and the Southern Tablelands tend towards zero in the final two decades of the study. The Northern and Central Tablelands showed corresponding peaks between 1899 and 1902.

In the Southern and Central Slopes, numbers of scalp returns tended towards zero (Fig. 5c). No dingo bounties were paid in the Southern Slopes after 1910, while the annual return in the Central Slopes was very low after this time. Despite large fluctuations in the curve for the Northern Slopes, scalp returns at the end of the study period were comparable to those of the 1880s. Both the Northern and Central Slopes show a peak in scalp returns between 1895 and 1903.

Scalp returns were in low numbers and declining on the Southern Plains for most of the study period (Fig. 5d). The number of bounty payments

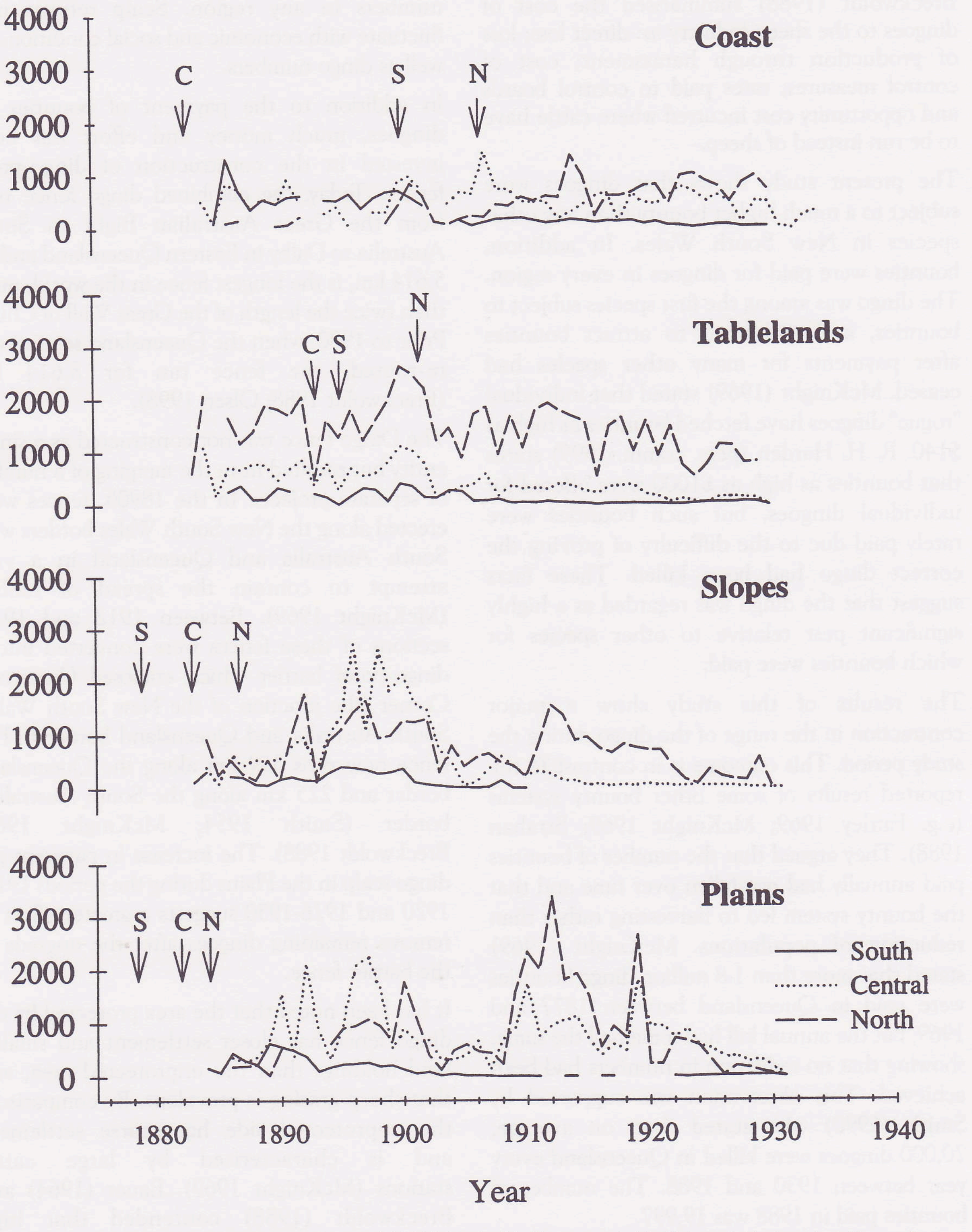

Figure 5. Annual scalp returns for (a) Coast, (b) Tablelands, (c) Slopes and (d) Plains plotted against time. Arrows indicate date of arrival of rabbits in each region as given by Stodart and Parer (1988). N – North; C – Central; S – South.

fluctuated greatly in the Central and Northern Plains but did not show any trend until the final decade of the study period. Between 1920 and 1930, scalp returns in the Central Plains and Northern Plains declined sharply towards zero. A peak occurred in both of these regions between 1908 and 1916, and again in 1919. There is no obvious or consistent relationship between bounty payments on dingoes and the arrival of rabbits in each district.

DISCUSSION

The importance of the dingo as a pest to pastoralists is not related simply to the direct loss of livestock. Harassment of sheep can lead to less than optimal use of pasture and mismothering of lambs (Thomson 1984). Meat may also be reduced in quality by dingo bites, even if the animal is not killed (Corbett 1995b). In 1975, the cost to industry of dingoes in Queensland was estimated at $40-50 million (Smith 1990).

Breckwoldt (1988) summarised the cost of dingoes to the sheep industry as: direct loss; loss of production through harassment; cost of control measures; rates paid to control boards and opportunity cost incurred where cattle have to be run instead of sheep.

The present study shows that dingoes were subject to a much higher bounty than any other species in New South Wales. In addition, bounties were paid for dingoes in every region. The dingo was among the first species subject to bounties, and continued to attract bounties after payments for many other species had ceased. McKnight (1969) stated that individual "rogue" dingoes have fetched bounties as high as $140. R. H. Harden (pers. comm. 1999) states that bounties as high as £1000 were offered for individual dingoes, but such bounties were rarely paid due to the difficulty of proving the correct dingo had been killed. These facts suggest that the dingo was regarded as a highly significant pest relative to other species for which bounties were paid.

The results of this study show a major contraction in the range of the dingo during the study period. This outcome is in contrast to the reported results of some other bounty systems (e.g. Fairley 1969; McKnight 1969; Strahan 1988). They argued that the number of bounties paid annually had not fallen over time and that the bounty system led to harvesting rather than reduction of populations. McKnight (1969) stated that more than 1.8 million dingo bounties were paid in Queensland between 1877 and 1969, but the annual kill had remained the same, showing that no reduction in numbers had been achieved. This observation was supported by Smith (1990) who stated that, on average, 20,000 dingoes were killed in Queensland every year between 1930 and 1988. The number of bounties paid in 1988 was 19,997.

Our results show a reduction in the number of scalp returns in three of the four regions (the Tablelands, Plains and Slopes regions all showed a reduction in scalp payments in 1921-1930 relative to the previous three 10-year intervals), with the most pronounced reduction in the Slopes region. In contrast, the number of bounties taken in the Coast region increased over time. This may indicate an overall decline of dingo numbers in the Tablelands, Slopes and Plains regions. However, as indicated earlier, scalp returns may not directly reflect dingo numbers in any region. Scalp returns may fluctuate with economic and social conditions, as well as dingo numbers.

In addition to the payment of bounties on dingoes, much money and effort has been invested in the construction of dingo-proof fences. Today, the combined dingo fence runs from the Great Australian Bight in South Australia to Dalby in Eastern Queensland and, at 5,614 km, is the longest fence in the world; more than twice the length of the Great Wall of China. Prior to 1980, when the Queensland section was re-routed, the fence ran for 8,614 km (Breckwoldt 1988; Olsen 1998).

The Dingo fence was not constructed as a single entity but resulted from the merging of a number of separate projects. In the 1890's, fences were erected along the New South Wales borders with South Australia and Queensland in a vain attempt to contain the spread of rabbits (McKnight 1969). Between 1912 and 1918, sections of these fences were converted into a dingo-proof barrier which enclosed Cameron's Corner (the junction of the New South Wales, South Australia and Queensland borders). The fence now runs 359 km along the Queensland border and 225 km along the South Australian border (Smith 1954; McKnight 1969; Breckwoldt 1988). The increase in payment per dingo scalp in the Plains during the periods 1916-1920 and 1926-1930 suggests a greater effort to remove remaining dingoes after the upgrade of the barrier fence.

It has been noted that the area protected by the dingo fence has closer settlement and smaller land holdings than the unprotected area, and that sheep grazing is prevalent. By comparison, the unprotected side has sparse settlement and is characterised by large cattle stations (McKnight 1969). Bauer (1964) and Breckwoldt (1988) contended that high numbers of dingoes preclude the running of sheep, and Olsen (1998) stated that the dingo fence is "probably the only solution if sheep farming is to continue east of the fence."

These conclusions are supported by the results of the present study. During the study period, the greatest numbers of sheep were grazed on the Southern Slopes, while the Central and Northern Slopes also carried large numbers (Butlin 1962). The pattern of contraction of the dingo's range shows that these were the areas in which dingoes showed the most rapid decline

(Fig. 3). This suggests that there may have been a greater emphasis on the control of dingoes because of the prevalence of sheep grazing in these areas. Conversely, the Coast and Tablelands, which supported the highest densities of dingoes, carried relatively low numbers of sheep (Butlin 1962).

These results suggest that the control efforts of pastoralists and hunters may have led to the decline of the dingo in New South Wales. This supports the view of Rolls (1969), who stated that, by 1863, few dingoes remained south of the Murrumbidgee River and Olsen (1998) who wrote that dingoes were scarce in much of south-eastern Australia by the 1930s. However, it does not follow that the bounty system was instrumental in this decline. Harden and Robertshaw (1987) found no relationship between the monetary value of bounties and the number of scalps submitted. In addition, they found that the majority of scalps had been returned by landholders or their relatives (as opposed to hunters with no vested interest in the land itself). They therefore contended that the protection of livestock provided the greater financial incentive for controlling dingoes and that bounty payments may have been trivial by comparison.

The present study supports this view. For example, the Central Coast region reported very high scalp returns throughout the study period while the value of bounties was less than £1 per scalp. Conversely, there are several examples of districts that offered relatively high bounties and reported low numbers of scalps, such as Narrandera and Wagga Wagga in the period 1886-1890 (Figs. 3, 4). It could be argued that bounties were necessarily smaller where dingoes were abundant because the payment of large bounties on large numbers of animals would have been too costly. The likelihood remains, however, that the cash value of the bounty was not the main incentive for the destruction of dingoes.

The fluctuations in scalp returns shown in Fig. 5 may be due to a combination of factors, including control by humans, drought, habitat destruction, the arrival of rabbits and changes in the availability of native prey. The index of abundance provided by scalp returns is not sufficiently accurate to draw rigorous conclusions. However, possible explanations can be offered for some of the more pronounced peaks.

One such peak occurred in the Central Slopes and Northern Slopes between 1895 and 1903. This may have been due to the arrival of rabbits which occurred five to ten years earlier (Stodart and Parer 1988). Dingo populations have been observed to increase with the resurgence of rabbits following a drought (Corbett 1995b). It seems likely, therefore, that similar increases occurred following the initial arrival of rabbits in Australia. However, the present study provides no evidence of such a response in other areas of the State (Fig. 5).

Several other pronounced but short-lived peaks occurred in various regions during the period of study. Some of these increases are attributable to very high returns from one district within a region. Harden and Robertshaw (1987) found that a high proportion of scalps submitted for bounty were presented by a few persistent and successful hunters. Thus, a highly localised increase in scalp numbers may be due to an increase in hunting activity by a small number of individuals. An example of such a localised increase is the peak in the curve for the Central Coast between 1900 and 1902 (Fig. 5a). This was due largely to high returns in the district of Port Stephens and was not accompanied by an unusually high bounty per dingo in this district.

A peak in scalp returns in the Northern Plains between 1908 and 1916 (Fig. 5d) is due to increased returns in Milparinka. The bounty offered did rise towards the end of this period, but not sufficiently early to explain the peak. The dingo fence, which runs adjacent to the Milparinka district, was being upgraded at this time (McKnight 1969). This may have been accompanied by a concerted effort to eradicate dingoes inside the fence, resulting in higher scalp returns.

In conclusion, the distribution of the dingo in New South Wales was reduced markedly between 1883 and 1930. Great importance was attached to the dingo as an agricultural pest, and persistent destruction by humans, in concert with the dingo fence which slowed the process of reinvasion, is likely to have led to its decline. It is unlikely, however, that the economic incentive of the bounty system was a necessary component of control. The control of dingoes in New South Wales appears to have been a prerequisite for the success of the sheep industry, and it is likely that the protection of livestock was the major incentive for the eradication of the species from much of the State.

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